Essay

New Tools for Marine Conservation: the Leasing and Ownership of Submerged Lands

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Abstract: *It has been assumed that strategies for estuarine and marine conservation must be substantially different than those for terrestrial conservation because the seas are all publicly owned. This is an unfortunate misconception. We explored the leasing and ownership of submerged lands as tools for marine conservation and provide examples of the implementation of these tools from The Nature Conservancy's work in Texas, Washington, and New York (U.S.A.). We found that the leasing and ownership of submerged lands are viable new tools for marine conservation. There is a significant amount of submerged land available for lease and ownership in the United States and other countries that includes a diverse array of ecosystems (e.g., kelp forests, marshes, seagrass meadows, oyster reefs, tidal flats, clam beds, scallop beds, sponge, and coral reefs). From our review of policy and experience in practice, we have identified some key benefits and considerations for the use of these tools. Conservation benefits for the leasing and ownership of submerged lands include opportunities to restore ecologically and economically important species, protect diversity in sanctuaries, draw on substantial terrestrial experience in leasing and ownership, buy land cheaply, develop ecologically sustainable harvest practices, partner with fishers and local communities to improve water quality, create control areas for research, and partake in local management forums as a direct stakeholder. Bivalve shellfish are particularly amenable to conservation with these tools because existing policy is well established for leasing and ownership rights to sessile animals that exist on the sea floor. Conservation buyers need to consider that community sentiment does not always favor private rights to submerged lands, conservation interest in submerged lands could affect prices, association with incompatible aquaculture practices will be detrimental, enforcement of restrictions can be difficult, and there may be concerns about setting the precedent of paying for conservation of submerged lands. Policy makers should be encouraged to include more opportunities for conservation and not just exploitation of natural resources on submerged land leases.*

Key Words: concessions, Galveston Bay, Great South Bay, land acquisition, protected areas, Puget Sound, shellfish, submerged lands

Nuevas Herramientas para la Conservación Marina: El Arrendamiento y Propiedad de Tierras Sumergidas

Resumen: *Se ha asumido que las estrategias para la conservación estuarina y marina deben ser sustancialmente diferentes de las de conservación terrestre porque los océanos son propiedad pública. Está es una imprecisión desafortunada. Exploramos el arrendamiento y propiedad de tierras sumergidas como herramientas para la conservación marina y proporcionamos ejemplos de la aplicación de estas herramientas a partir del trabajo de The Nature Conservancy en Texas, Washington y New Cork (E. U. A.). Encontramos que el arrendamiento y la propiedad son nuevas herramientas viables para la conservación marina. En Estados Unidos y otros países hay una cantidad significativa de tierras sumergidas disponibles para el arrendamiento y apropiación que incluyen una amplia gama de ecosistemas (e.g. bosques de algas, marismas, praderas de pastos marinos, arrecifes ostrícolas, bancos de almejas, arrecifes de esponjas y corales). A partir de nuestra revisión*

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de políticas y experiencia en la práctica, hemos identificado algunos beneficios y consideraciones clave para el uso de estas herramientas. Los beneficios de conservación para el arrendamiento y apropiación de tierras sumergidas incluye oportunidades para restaurar especies ecológica y económicamente importantes, proteger la diversidad en santuarios, retomar experiencia en el arrendamiento y apropiación de ambientes terrestres, adquirir tierra barata, desarrollar prácticas de cosecha ecológicamente sustentables, asociarse con pescadores y comunidades locales para mejorar la calidad del agua, crear áreas de control para investigación y participar en foros locales como actores directos. Los moluscos bivalvos son particularmente sensibles a la conservación con estas herramientas porque la política actual está bien establecida para derechos de arrendamiento y propiedad sobre animales sésiles que habitan en el fondo del mar. Los compradores de conservación deben considerar que el sentimiento de la comunidad no siempre favorece derechos privados para tierras sumergidas, el interés por conservar tierras sumergidas podría afectar precios, la asociación con prácticas acuaculturales incompatibles será perjudicial, la ejecución de restricciones puede ser difícil y puede haber muchas preocupaciones por establecer el precedente de pagar por la conservación de tierras sumergidas. Se debe alentar a los legisladores para que incluyan más oportunidades para la conservación, y no sólo la explotación, de recursos naturales en tierras sumergidas arrendadas.

Palabras Clave: adquisición de tierra, áreas protegidas, Bahía Galveston, Bahía Great South, concesiones, mariscos, Puget Sound, tierras sumergidas

Introduction

Emerging threats to the marine environment challenge us to find innovative ways to protect its rich resources. As burgeoning coastal populations increase pressure on the limited resources of the coastal seas, threats to the marine environment grow rapidly (National Research Council 1995; Hinrichsen 1998; Burke et al. 2001). Conservation of estuarine and marine systems lags far behind conservation of terrestrial systems (Beatley 1991; National Research Council 2001). Only a handful of tools have been used successfully for marine conservation. Significant focus has been given recently to one tool, no-take marine reserves (Roberts & Hawkins 2000; Jamieson & Levings 2001; National Research Council 2001; Pauly et al. 2002).

An expanded toolkit is needed for marine conservation. Some of the most successful tools for terrestrial conservation have been the acquisition and management of natural resources through ownership, easements, and leases of land by private conservation organizations. These tools have been used successfully in the terrestrial environment by countless groups from international organizations to local land trusts.

It has been commonly assumed that the tools for estuarine and marine conservation must be substantially different from those for terrestrial conservation, in part because it is not possible to own parts of the oceans. For example, many recent papers and books note extensive marine degradation and identify many tools for marine conservation that are or should be employed, but there is no mention of leasing or ownership of submerged lands as possible marine conservation tools (e.g., Beatley 1991; Milewski 1995; Wilder 1998; Helvarg 2001; Virnberg & Virnberg 2001; Dayton et al. 2002).

Submerged lands are in fact widely available for lease and ownership. It has been estimated that nearly one-third of the submerged lands of U.S. coastal states are privately leased or owned (Slade et al. 1997). Submerged lands have been bought, sold, and leased for centuries for the exclusive use, management, and harvest of natural resources (e.g., McCay 1998). Billions of dollars are spent every year by business interests to lease and develop submerged lands for oil, public marinas, private docks, and other purposes. The leasing of submerged land for fisheries and aquaculture is a large and growing business (Goldburg & Triplett 1997; DeVoe 1999). For example, most of the southeastern coast of Louisiana is gridded and leased for oyster harvest (Louisiana Department of Wildlife and Fisheries 2003). However, the leasing and ownership of submerged lands have been rarely used as tools for marine conservation in the United States or internationally.

We explored the leasing and ownership of submerged lands as tools for marine conservation and examined some of their benefits and considerations for the conservation and restoration of marine species and ecosystems. We focused mainly on the United States but examined some opportunities to use these tools in other countries. We illustrate the use of these tools with projects of The Nature Conservancy in New York, Washington, and Texas (U.S.A.) and show that these are viable new tools for marine conservation.

Leasing and Ownership of Submerged Lands in the United States

We examined submerged-lands policy in the coastal states of the United States to identify opportunities for conservation. There are three possible forms of ownership of submerged lands: leases of submerged lands from states, limited ownership of submerged lands sold by states, and

outright ownership (in fee simple) of lands conveyed into private ownership prior to statehood. For leasing opportunities, we gathered information from managing agencies on the process for attaining a lease, the availability of land, and specific information about leasing options and requirements. We defined submerged lands as "land lying below tidal waters, seaward of the ordinary low water mark including bays, inlets and other arms of the sea, out to the seaward boundary of the State" (Slade et al. 1997). The seaward boundary of the state, as defined by the Submerged Lands Act of 1953, extends 4.8 km (3 miles) out for most states, except Florida and Texas, where it is 16.7 km (3 marine leagues) into the Gulf of Mexico. Submerged lands beyond these boundaries are under federal jurisdiction, and we did not consider them directly. In many states (e.g., Texas), intertidal lands are governed similarly to submerged (i.e., subtidal) lands.

Leasing

All coastal states allow leasing in some portion of their waters. Leasing has been used historically as a tool to manage coastal activities and maximize economic benefits to the public (e.g., Archer et al. 1994). The submerged lands available for lease include a diverse array of ecosystems such as kelp forests, marshes, seagrass meadows, oyster reefs, tidal flats, clam beds, scallop beds, and sponge and coral gardens. In California, for example, up to half of the state's giant kelp forests are leaseable (California Department of Fish and Game 2000). In Florida, sponge and soft coral habitats are leased. Seagrass ecosystems can be a part of leased lands, as in Virginia. In Louisiana in 2003, 165,672 ha of submerged lands were leased for oyster harvest on 8578 separate leases (Louisiana Department of Wildlife and Fisheries 2003).

In general, the leasing process is straightforward: a potential lease area is identified by the interested party or the state and then surveyed to determine its appropriateness. During this survey stage, some states require that the application be available for public comment. Once approved, a lease is granted for a period of time, often 5–10 years but as long as 30 or more years or as short as 1 year (Appendix 1). Many leases are renewable. Depending on lease terms, the lessee may receive exclusive harvesting rights of the submerged land, although generally receives few rights to restrict use of the water column or surface. This is changing in some areas, however, as finfish aquaculture, which can require cages that occupy most or all of the water column, becomes more common. Many states have developed leasing policies to encourage commercial production, and quotas may be set on planting, production, and harvesting (Appendix 1). There are opportunities to lease areas without harvest or production requirements. Some state policy explicitly allows for open competition and bidding for leases. In California it is possible to bid for kelp forest leases, but there are still leases currently available (California Department of Fish and Game 2000).

Nationwide the most common type of leases on which environmental conservation could be amenable and allowable under existing policies are for native shellfish beds (Appendix 1). Existing policy and property rights are well developed for the lease of (nearly) sessile animals that exist in or on the sea floor because they are clearly tied to the submerged land property. From a conservation perspective, bivalve shellfish are some of the ecologically most important species in coastal waters. They affect or control many ecological processes, including primary production, nutrient cycling, and water clarity, and thus have been called ecosystem engineers (Cloern 1982; Officer et al. 1982; Newell 1988; Ray 1996; Lenihan & Peterson 1998). In addition to their role in filtering water, some shellfish also play critical roles in providing food, shelter, and habitat for other estuarine and marine species (Breitburg 1999; Coen & Luckenbach 2000).

Many shellfish and their ecosystems have been heavily affected by human activities, and leasing could abate threats and restore these systems. Many shellfish were historically abundant (e.g., Kennedy & Sanford 1999) but have declined drastically in abundance because of overharvesting, poor water quality, and diseases (National Research Council 2003). The combination of increased nutrients and other pollutants running into coastal waters and decreased shellfish populations has had huge a ecological impact on many bays and estuaries (Newell 1988; Rothschild et al. 1994; Lenihan & Peterson 1998; Coen et al. 1999; Jackson et al. 2001; Lenihan et al. 2001). In general, estuaries contain some of the most degraded habitats on Earth because inappropriate decisions in land and river management accumulate downstream (Edgar et al. 2000; Mitsch et al. 2001). Because shellfish filter large quantities of water, they can reduce levels of bacteria, phytoplankton, and other particulate matter in water bodies. The restoration and conservation of shellfish ecosystems on submerged lands should encourage stakeholders and local communities to take a strong interest in water quality and the link between estuaries and their watersheds.

Ownership

Most privately owned submerged lands were sold by states, and although the private owner may hold title to the submerged lands, the state retains some rights. Retained rights vary by state and even by parcel but often include rights to access and navigation. These rights are a source of litigation (Slade et al. 1997). The courts have generally upheld that any rights not clearly granted in the title to a private owner remain with the state. In Washington large portions of the nearshore areas of Puget Sound are in private ownership, including some 61% of the state's extensive intertidal zone (Murray 1998).

In many states it is possible to own submerged lands outright (in fee simple), in which case the state does not retain rights. This type of ownership stems from conveyances of submerged lands given prior to statehood, in accordance with international treaties, Native American treaties, and in a few other special cases (Slade et al. 1997). States where it is possible to own submerged lands outright include, among others, Alaska, Virginia, Florida, New York, Washington, North Carolina, California, Massachusetts, and Hawaii. The key ecological features that make shellfish ideal for conservation leases also make them good candidates for conservation ownership projects: they are sessile, bottom dwellers, and ecosystem engineers.

Applying the Tools for Conservation and Restoration

The Nature Conservancy (TNC) has been leasing and buying submerged land for environmental conservation and restoration purposes at sites in Galveston Bay, Texas; Puget Sound, Washington; and Peconic Bay and Great South Bay, New York.

In 1997 TNC signed a 5-year agreement to lease Pierce Marsh, a 551-ha tract of intertidal salt marsh and subtidal mudflats in Galveston Bay, Texas, for a one-time fee of $25. This tract had experienced significant loss of marsh habitat due to subsidence from groundwater withdrawal. Subsidence rates decreased dramatically when nearby groundwater could no longer be extracted and conditions became suitable for large-scale marsh restoration. Salt marshes provide critical habitat for coastal plants and animals, and they have declined at precipitous rates, particularly in the northern Gulf of Mexico (Beck et al. 2003; Minello et al. 2003).

The Pierce Marsh restoration efforts involved a coalition of partners led by The Galveston Bay Foundation and TNC. In 1999 25 ha of salt marsh were restored with the assistance of hundreds of volunteers who planted 48,300 marsh plants. In 2001 a further 18 ha of marsh was restored. These restoration projects employed an innovative marsh-terracing technique that is effective for restoring the abundance of many marsh plants and animals (Rozas & Minello 2001). These marsh restoration projects provide ecological benefits by stemming coastal habitat loss. They also may provide economic benefits by increasing nursery habitat for commercially important species and by buffering shorelines from storms and erosion. The Pierce Marsh lease has been renewed by TNC, and further restoration efforts are in progress. The lease was necessary for the restoration activities required to build up and stabilize the marshes.

In Washington TNC recently bought 1668 ha in the tidal zone of Port Susan Bay. These lands were originally sold by the state. The property, at the mouth of the Stillaguamish River, provides critical habitat for thousands of migrating birds; coho (*Oncorhynchus kisutch*), chum (*O. keta*), and chinook (*O. tshawytscha*) salmon; steelhead (*O. mykiss*) and sea-run cutthroat (*O. clarki clarki*) trout, and herring (*Clupea pallasi*). Recently, much of Port Susan's shellfishing grounds were closed because of water-quality problems. There also has been an influx of non-native species in the salt marshes and the shellfish beds. In addition, the diking of agricultural lands and decreases in large woody debris washing downriver have led to losses in estuarine channels and sloughs that are key transitional habitat for salmonids (Kareiva et al. 2000). The Nature Conservancy is in the process of creating a conservation management plan at Port Susan Bay and a restoration strategy for shellfish, salmon, and other estuarine animals. Currently, restoration projects are in progress to remove an invasive species (*Spartina alterniflora Loisel*) from the salt marshes.

In New York TNC has acquired direct ownership of over 4800 ha of submerged lands in the Great South and Peconic bays; these lands were initially granted into private ownership prior to New York statehood and thus are owned outright by TNC. Some of the major threats in these bays arise from overharvesting of shellfish and excess nutrient input leading to poor water quality and in some cases brown tides. In December 2002 TNC acquired over 4653 ha along the bottom of the Great South Bay. This area represents approximately 25% of the bay. The First Republic Corporation, the parent company of the Bluepoints Oyster Company, donated the underwater property, valued at $2.4 million, to TNC. The Nature Conservancy has formalized a Bluepoints Bottomlands Council that consists of local partners and is working with them to develop a multiuse management plan for the property. The overall aim is to restore and preserve ecological functions on the property with the expectation that these activities will positively influence and improve conditions throughout Great South Bay. Success of the Bluepoints project will be realized through comanagement of the property, with governmental and nongovernmental groups playing an active role in research, stewardship, restoration, preservation, education, and public use.

The Nature Conservancy also acquired 81 ha of underwater land from the First Republic Corporation in Pipes Cove in Peconic Bay. Unlike the Great South Bay property, ownership of this underwater land is tied to use of the property for the purposes of shellfish cultivation. The Nature Conservancy is working on a conservation plan for the Pipes Cove underwater property that will include provisions for environmentally sensitive shellfish aquaculture and eelgrass restoration as well as the creation of spawner sanctuaries, where shellfish will not be harvested and will be allowed to reach full spawning potential.

The development of strategies to restore shellfish and improve water quality on these new acquisitions will follow some of the same basic plans used on submerged

lands obtained earlier in Peconic Bay, New York. These submerged lands came with the acquisition of a large tract of upland on Shelter Island, the Mashomack Preserve. Since the 1960s, TNC had leased this portion of its bay bottom to the town of Shelter Island for $1 annually to allow wild harvest by local shellfishers. In 2000 TNC first began work to enhance bay scallop and hard clam populations and to restore ecological processes in Peconic Bay by culturing bay scallops in tidal creeks on the Mashomack Preserve. In 2002 TNC rescinded its lease to the town to create a no-take spawner sanctuary on TNC-owned bay bottom. Although the submerged land is no longer available for wild harvest, local shellfishers support efforts to create a spawner sanctuary on TNC-owned lands.

The work on TNC-owned properties led to further partnerships with shellfishers and local towns to create nine no-take spawner sanctuaries for hard clams and bay scallops on town-owned bay bottom in Peconic Bay. A total of 170,000 hard clams and 240,000 bay scallops were planted in 10 sanctuaries. These efforts are part of a field test of lab results that suggest these filter feeders will help control the development of brown tide, an algae phenomenon that severely degrades water quality and clarity, eelgrass beds, and the overall condition of the bay.

These projects demonstrate that the leasing and ownership of submerged lands can help conservationists stem coastal habitat loss, remove invasive species, restore fish populations, establish sanctuaries, improve water quality, and involve local stakeholders in partnerships to conserve coastal and marine biodiversity.

Leasing and Ownership Opportunities outside the United States

Although a more systematic analysis has not been completed, opportunities for the lease (sometimes known as concession) and ownership of submerged lands and waters occur in many countries. This appears to be particularly true in areas where there is a strong tradition of community-level ownership of marine resources such as is common in the South Pacific (e.g., Wells 1998). In many Pacific Islands, submerged lands are owned by local communities in much the same way that terrestrial lands are owned and managed. These local communities lease their lands to fishers, including those involved in the trade of live reef fish and in pearl harvesting, as is done for example in the Raja Ampat Islands of Papua. In Chile the government has been granting numerous marine concessions for commercial purposes in large part to support the growing salmon aquaculture industry (Hennicke 2002).

Leases have also been used for more conservation-oriented purposes. For example, there is a lease agreement between the villages of Lamanggau in southeastern Sulawesi in Indonesia and the Wakitobi Dive Resort. Villages receive payment in exchange for agreement not to undertake in activities that might damage the reef ecosystems, such as overfishing, mining, and harvesting mangroves. The dive facility also agrees to certain conditions regarding its dive operation.

On Chumbe Island in Zanzibar, Tanzania, a private organization, Chumbe Island Coral Park Limited (CHICOP), has management authority over a small coral island and the surrounding reefs (Riedmiller 1998). The CHICOP has a lease on the terrestrial lands for 33 years and an exclusive management agreement for the coral reefs (10 years), and the lands above and below water are managed for conservation and ecotourism.

The National Trust, a nongovernmental organization in the United Kingdom, leases intertidal lands and seabeds from the government along some 180 km of the coast. These are connected to tracts of coastal upland owned by the National Trust (53,000 ha) that cover 969 km of the coast. The trust balances the needs of conservation with public access and safety on their lands.

Benefits and Considerations for the Leasing and Ownership of Submerged Lands

We have found that the lease and ownership of submerged lands are viable tools for marine conservation, and there are many opportunities for further use of them. From our review of policy and experience in practice, we have identified some key benefits of and considerations for the use of these tools. In this section, we refer strictly to the lease and ownership of submerged lands for purposes of environmental conservation and restoration of marine biodiversity.

Benefits

Some of the benefits for conservation organizations considering leasing and ownership of submerged lands include opportunities to (1) restore and enhance ecologically and economically important species, (2) protect diversity in sanctuaries, (3) draw on substantial terrestrial experience in leasing and ownership, (4) buy land cheaply, (5) develop ecologically sustainable harvest practices, (6) partner with fishers and local communities to improve water quality, (7) create control areas for research and monitoring, and (8) partake in local management forums as a direct stakeholder.

Marine conservationists can benefit from the long-standing use of leasing and ownership tools in terrestrial conservation. Lessons from terrestrial experiences may translate well to the marine environment and may be welcome additions to existing marine management practices.

Prices on submerged lands for leases and ownership in state waters are generally orders of magnitude lower

than those for terrestrial lands (Appendix 1). In the state of Washington, for example, a comparable sales estimate for a property with uplands and submerged lands showed that the diked agricultural uplands were worth $8645/ha, intertidal salt marshes were $3705/ha, and submerged lands were $370/ha (B. C. Allen, personal communication).

A direct benefit of leasing and ownership is that it is possible to set aside areas for conservation and to restrict the most harmful activities such as anchoring or resource extraction. Opportunities to use leased submerged lands to conserve biodiversity (without extractive resource use) are not common, at least in the United States, although some states are developing them (e.g., Washington). In states that require fisheries production on leased lands, it may be possible to consider the larvae exported from conservation leases (e.g., spawner sanctuaries) as significant seed production and thus meet state-mandated production requirements.

Leased and owned areas can serve as research and control sites. In addition to increasing our understanding of critical ecological processes and ecosystem services, research areas can also offer full protection. No matter what kind of conservation or management approach is taken, at least some areas will need to be left as control areas to test whether or not management approaches are successful.

Many projects on submerged lands, particularly restoration projects, are amenable to community outreach and educational activities. Examples of community-based activities around restoration projects include shell recycling programs, habitat building, and monitoring efforts done by volunteers. These types of activities involve the community in conservation efforts and help gain their support for conservation (e.g., Karney 2000).

Many benefits can be derived by working with stakeholders and partners to develop an ecologically sustainable management plan on lands leased and owned by conservation groups. A plan that allows restoration and some sustainable harvest gives conservationists the opportunity to work with fishers instead of the all-too-common occurrence of creating antagonism between these stakeholder groups. For example, shellfishers and conservationists should be natural allies in the development of best management practices to improve water quality, which directly affects the number of areas open to shellfish harvest. Recreational and commercial fishers may also support projects that enhance habitats (e.g., oyster reefs) that then serve as nurseries for the juveniles of other fishes and invertebrates (Beck et al. 2001; Beck et al. 2003).

The restoration of species and ecosystems can have economic benefits for communities even without harvest. Local economies can benefit indirectly through improved habitat and water quality and other ecosystem services. The services offered by coastal ecosystems are some of the most valuable on earth (Costanza et al. 1997). Restored areas also may be more amenable to ecotourism, recreational fishing, kayaking, birding, swimming, and other recreational activities that enhance local economies.

As a direct stakeholder in the marine environment and its resources, a conservation organization that is a leaseholder or landowner can get a "seat at the table" in the development of local and regional management policies that would affect these resources. This opportunity can increase the conservation input to local and regional management councils responsible for the management of watersheds, coastal development, fisheries, and other resources.

Considerations

In addition to the potential benefits from the conservation leasing and ownership of submerged lands, we have also found there are considerations to be weighed. Conservationists need to be aware that (1) community sentiment is not always in favor of private rights to submerged lands, (2) conservation interest in submerged lands could affect prices, (3) association with unsustainable aquaculture practices will be detrimental, (4) enforcement of any restrictions can be difficult, and (5) concerns may arise about the precedent of paying for conservation of submerged lands.

Potential buyers need to be aware of community sentiment about restrictions on access to submerged lands. Some places have a long history of combativeness toward attempts to grant individual rights to marine resources (e.g., McCay 1998). Conversely, in some states in the United States and in other countries, these rights are widely accepted as being in the best interest of all stakeholders and the natural resources.

Increased interest in leasing or ownership of submerged lands could cause price increases. Given the low prices for submerged lands, even significant increases would not be overly burdensome. In addition, in some states there has been open competition for the lease and ownership of submerged lands by business interests for over a century. This competition has not particularly affected prices and should not be a reason for conservation interests to continue to stay out of this market.

Leases may only offer short-term protection. When the lease period is up, any effects of protection or restoration could be lost. Many leases are relatively long-term, however, and are often renewable. Leasing could create short-term conservation and allow for the time and opportunity to get long-term conservation measures in place at these or other sites.

For restoration projects, there is an additional consideration that effort may be better spent on conservation, especially if these species or ecosystems are in better condition elsewhere. The success of restoring species is still in question (e.g., Hutchings 2000), and it may be even more difficult to fully restore ecosystems (e.g., Minello

& Webb 1997; Zedler 2000). Owing to extensive coastal degradation, however, an exclusive focus on conservation is not always possible.

Conservation projects that include harvest of natural resources should be designed to be sustainable in the short and long term. Intensive or destructive harvesting should be avoided. Harvest that is allowed should not detract greatly from the conservation benefits of the project.

Project managers should avoid association with the practice of incompatible aquaculture. There is much to be learned from the aquaculture industry in the development and use of environmentally sound practices that increase the abundance of key species, but many practices in aquaculture are unsustainable at best and can be destructive. Environmentally incompatible practices create an influx of invasive species, degrade the genetic stock of native species, deplete wild stocks, alter or destroy natural habitats, or poison or kill other organisms in the community (e.g., Goldburg & Triplett 1997; Naylor et al. 2000, 2001).

Enforcement of restrictions on access to leased or owned submerged lands can be expensive. It may be possible to develop partnerships with local management authorities to help enforce restrictions. Better yet, partnerships with local stakeholders may be effective. For example, a conservation lessee or owner may sublease sustainable harvest rights to local fishers, who can provide effective enforcement. These fishers often have enforced harvest limits on their own leases for years and have experience at limiting illegal access. Other possibilities for enhancing protection include developing projects in places where access may already be partly restricted and controlled (e.g., near military bases) or where extraction is unhealthy to humans (e.g., shellfish are deemed unfit for human consumption when waters have even low levels of fecal coliform; low levels have little or no impact on shellfish ecosystems).

There may be concern about setting the precedent of paying for conservation of submerged lands when it should be the responsibility of government to protect these areas for future generations. In the United States the mandate for governance of state-owned submerged lands is strongly affected by the Public Trust Doctrine (PTD), which generally requires state agencies to hold their coastal lands and waters in trust for the public good (Slade et al. 1997). The doctrine has been used by a number of groups as a tool to promote government conservation of coastal resources (e.g., New York/New Jersey Baykeeper 2001), but it has also provided the arguments for access, development, and use of coastal resources, which can be counterproductive to conservation. It will not be helpful to weaken the conservation potential of the PTD. However, the lease and ownership of submerged lands by conservation groups, on par with other coastal resource users and developers, need not weaken the PTD. Private, market-based opportunities should be an addition to marine conservation and management just as they have been in the terrestrial environment; they should not take the place of marine protection efforts by local and national governments.

Future Opportunities: Changes in Policy

Conservation opportunities exist within the scope of current state policy on submerged lands, but changes to policy should be sought. Most state policy on leasing and ownership has been developed for the use of natural resources for business. This is not surprising because state policy makers are approached regularly by resource users.

Leasing policies have been under consideration and have been changing in a number of states, in part because of the rapid growth of the aquaculture industry and coastal development (e.g., marinas). Business interests have a right and need to access these submerged lands within a consistent and stable regulatory environment; they generally have had this access. Due consideration should also be given to policy that would allow more leasing for research, conservation, and restoration purposes or require mitigation for other leasing that degrades public trust lands.

There should also be more parity in the rights afforded to leases used for conservation and business purposes. For example, it can be difficult to limit detrimental activities on submerged lands leased for restoration and conservation purposes because rights of access (e.g., for navigation and fishing) are viewed as paramount in many state policies. Nonetheless, rights to deny access are regularly granted to business interests (e.g., for marinas and finfish aquaculture). Similar rights could also be granted to conservation interests.

State policy is improving. For example, Washington State's Department of Natural Resources (WADNR) is designing a new leasing program for submerged lands for conservation and restoration purposes. Historically, Washington has leased submerged lands largely for resource extraction (shellfish farming, wild geoduck harvest) and construction (piers, armoring structures, marinas), and it has authorized relatively few restoration or enhancement projects. However, the current WADNR administration has taken a different approach to restoration, enhancement, and preservation activities. To accomplish this, the WADNR is developing two types of use authorization: a conservation lease and a conservation license. The aim of the new policy is to offer opportunities for other government agencies and nongovernmental organizations to invest in the restoration and conservation of submerged lands and to provide term-limited protection for these investments under a continuing lease. The leasing policy of WADNR may serve as a good model for other states.

Conclusion

The leasing and ownership of submerged lands offer many exciting possibilities for better conservation and management. Conservation organizations can use existing policy to lease and own submerged lands for the protection and restoration of ecologically functional communities. These projects can be cost-effective and offer important ecological benefits in coastal ecosystems. They also can help local stakeholders secure long-term protection for important habitats, restore ecological processes in coastal watersheds, improve fisheries resources, and enhance the quality of life and economic security of local communities.

The leasing and ownership of submerged lands can be important conservation tools and should complement other marine conservation tools, such as marine reserves. In the short term, efforts should focus on site-based projects to examine the further applicability of leasing and ownership to marine conservation. In the medium term, efforts should be made to improve state policy opportunities for conservation leasing and ownership. In the longer term, it is possible that the conservation lease and ownership of submerged lands will emphasize the need for states and countries to develop comprehensive zoning plans for their coasts. This zoning is increasingly necessary to reduce conflicts among stakeholders.

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Appendix 1. Opportunities and requirements for the lease of shellfish beds in U.S. coastal states.[a]

State	*Lead agency*	*Initial fee*	*Annual fee*	*Production quota*	*Lease period*
Alabama	Department of Conservation, Marine Resources Division	site dependent	site dependent	yes	annual, renewable
Alaska	Department of Natural Resources	$100 + acreage-specific bond	$350 first acre, $150 each additional acre	$3000 in sales/acre in year 5 of lease	10-year maximum
California	Department of Fish and Game	$400	$10/acre	2000 oysters/acre/year	25-year maximum
Connecticut	Department of Agriculture	$200	$2/acre	no	3–10 years
Delaware	Department of Natural Resources and Environmental Control	$70	$11.50/acre	no	annual
Florida	Department of Agriculture and Consumer Services	$200	$25/acre	no	10-year maximum
Georgia	Department of Natural Resources	state not identifying new lease areas	site dependent	yes	5-year renewable
Hawaii	Department of Land Management	$100	$50/acre + 1% of gross revenues	yes	15 years (option for more)
Louisiana	Department of Wildlife and Fisheries	$250	$2/acre	yes[b]	15-year maximum
Maine	Department of Marine Resources	$100–1000	$3.50/acre	no	10-year maximum
Maryland	Department of Natural Resources, Fisheries Service	$300	$3.50/acre bottom; $80/acre water column	yes[b]	15–20 years
Massachusetts[c]	Department of Food and Agriculture				
Mississippi	Secretary of State, Public Lands Division	$150	$25	yes[b]	
New Hampshire	Department of Fish and Game	$200	$200	no	annual
New Jersey	Division of Fish and Wildlife, Bureau of Shellfisheries	$290	$2/acre		
New York	Department of Environmental Conservation	$100	$100	no	1 year
North Carolina	Division of Marine Fisheries	$100	$5/acre	10 bushels/acre/year	10-year maximum
Oregon	State Lands Board, Division of State Lands	$25	$2	no	indefinite
Rhode Island	Coastal Resources Management Council	$100–200	$150 first acre, $100 each additional acre	yes[b]	5-year maximum
South Carolina	Department of Natural Resources, Marine Resources Division	$25	$5/acre	yes[b]	5-year maximum
Texas	General Lands Office	site-dependent	site dependent	yes[b]	1–20 years
Virginia	Marine Resources Commission	$25 + survey	$1.50	no	10 years
Washington	Department of Natural Resources	$25	30% upland value	no	12–30 years

[a] *The main state-level agency is indicated. In some states, several agencies at local and state levels may have some control over the leasing of submerged lands for shellfish and other coastal resources. Other forms of leasing, such as for aquaculture or marinas, often have different lead agencies, fees, and lease periods.*

[b] *Commercial activity is required, but there is no set minimum harvest.*

[c] *Leases not granted at the state level. Leases can be obtained for town-controlled submerged lands. Policy varies by township.*